

Association for Information Systems AIS Electronic Library (AISeL)

ICIS 2000 Proceedings

International Conference on Information Systems
(ICIS)

December 2000

Knowledge Sharing Practices and Technology Use Norms in Dispersed Development Teams

Deborah Sole
Harvard Business School

Lynda Applegate
Harvard Business School

Follow this and additional works at: <http://aisel.aisnet.org/icis2000>

Recommended Citation

Sole, Deborah and Applegate, Lynda, "Knowledge Sharing Practices and Technology Use Norms in Dispersed Development Teams" (2000). *ICIS 2000 Proceedings*. 61.
<http://aisel.aisnet.org/icis2000/61>

This material is brought to you by the International Conference on Information Systems (ICIS) at AIS Electronic Library (AISeL). It has been accepted for inclusion in ICIS 2000 Proceedings by an authorized administrator of AIS Electronic Library (AISeL). For more information, please contact elibrary@aisnet.org.

KNOWLEDGE SHARING PRACTICES AND TECHNOLOGY USE NORMS IN DISPERSED DEVELOPMENT TEAMS

Deborah Sole
Lynda Applegate
Harvard Business School
U.S.A.

Abstract

Dispersed, cross-functional development teams—a particular type of virtual team—confront a wide range of knowledge-based challenges in their dispersed work. Encompassing diverse sources of task-relevant knowledge, such teams present rich opportunities for exchanging and combining knowledge—activities at the heart of an organization's ability to innovate (Grant 1996; Schumpeter 1934). Yet empirical studies from distinct research streams indicate that both knowledge diversity and geographic separation also challenge the effective exchange and ability to leverage knowledge. This study explored how such teams interact to overcome the barriers and reap the benefits of their “built-in” knowledge diversity. In particular, we sought to understand (1) how teams use various collaborative technologies at their disposal to share knowledge and (2) whether shared—or disparate—expectations around the use of those technologies influenced knowledge sharing practices. In-depth, multi-method field research of dispersed new product development teams in a multinational company forms the empirical basis of this work.

Keywords: Organizational learning, knowledge diversity, knowledge sharing, virtual teams, collaborative technologies, case study, manufacturing sector, research and development

1. INTRODUCTION

The ability to continuously learn and effectively innovate is central to competitive advantage in a rapidly changing world. Learning and innovation entail combining previously disconnected funds of knowledge or combining existing knowledge in novel ways (Grant 1996; Schumpeter 1934). Thus, interest in the study and practice of intentionally facilitating opportunities for knowledge combination and exchange in organizations has increased substantially among management academics, consultants, and practitioners (see Alavi and Leidner 1997; Davenport and Prusak 1998; Garvin 1997; Hansen et al. 1999; Ruggles 1998; Zack 1999a, 1999b).

One approach to facilitating knowledge combination and exchange is through geographically dispersed teams or “virtual teams” (Duarte and Snyder 1999; Jarvenpaa et al. 1998; Leonard et al. 1998; Rennecker 1999; Townsend et al. 1998). Dispersed teams have long existed but their prevalence has accelerated with improvements in computer mediated communications (Cramton and Webber 1999). Dispersed or virtual ways of working, supported primarily by advanced communication and collaborative technologies,¹ have been offered as a way to respond to expertise constraints, created by downsizing, mergers and acquisitions, globalization, and employee preferences (Boutellier et al. 1998; Townsend et al. 1998). Some collaborative technologies have been shown to facilitate ad hoc contact with remote professional expertise within the organization (e.g., Constant et al. 1996; Goodman and Darr 1996, 1998), as well as beyond the organization at reduced costs (Pickering and King 1995).

¹We define collaborative technologies broadly as those technologies enabling individuals and groups to communicate, collaborate, and interact to share knowledge and information, focusing on those that facilitate dispersed interaction across time and/or space. Examples include telephone, audio- and video-conferencing facilities, electronic messaging, electronic discussions, online chat environments, application sharing, desktop conferencing, and shared document repositories.

Although virtual teams are foreseen as an increasingly common and important form of working in the 21st century (Handy 1995; Townsend et al. 1998), our conceptual understanding of such groups is still underdeveloped (Cramton 1999). We sought to expand the conceptual and empirical work on dispersed teamwork by exploring the role of technology use in the knowledge sharing practices of a particular type of virtual team, the dispersed, cross-functional development team. Such teams need to integrate and apply their knowledge effectively in order to achieve their collective goal. Important research questions are:

- How do dispersed, cross-functional teams engage in sharing knowledge?
- How do they use the available collaborative technologies in sharing knowledge?
- What role do technology use norms play in such engagements?

This study is situated at the nexus of research on virtual teams, product development processes, knowledge in organizations, and information and communication technology use; hence it acknowledges and builds from a variety of different literatures.

2. CONCEPTUAL FOUNDATIONS

2.1 Sharing Knowledge in Dispersed, Cross-Functional Development Teams

Geographically dispersed, cross-functional teams are increasingly espoused for enhancing learning and innovation, especially in research and development activities (Boutellier et al. 1998; De Meyer 1993a, 1993 b; Gorton and Motwani 1996; Leonard 1995; Madhavan and Grover 1998; Prokesch 1997). Cross-functional teams that successfully draw on the diverse funds of knowledge of members from different intellectual and occupational backgrounds are expected to be more creative (Leonard 1995; Madhavan and Grover 1998). By leveraging team members' different perspectives and their access to different sources of information, such teams should be more effective (Brown and Eisenhardt 1995). The participation of *dispersed* knowledgeable resources, in particular, is additionally expected to facilitate understanding and dealing with global clients and suppliers (Boutellier et al. 1998).

Despite the ostensible advantages of diverse knowledge, empirical evidence suggests that knowledge diversity constrains effective sharing. These constraints have both occupational and contextual origins. Differences in perspectives, priorities, typical approaches to problem solving, and even terminology, present among different functional units (Dougherty 1992) and occupational workgroups (Bechky 1999) can hinder understanding and team cohesion. Dougherty notes that these "interpretive barriers" may be reduced through team members engaging in highly interactive and iterative exchanges, but it remains to be explored how these tactics might translate into a dispersed team setting, where members are limited in their opportunities to interact face to face.

Diverse knowledge derived from specific social or physical contexts also hinders knowledge sharing across localities (Argote and Ingram 2000; Lam 1997; Szulanski 1995; von Hippel 1994; Zander and Kogut 1995). Knowledge manifest in action, such as skill to use a tool or machine, is frequently inseparable from the context of tool and activity (Polanyi 1966; Ryle 1949), and physical proximity—enabling ongoing dialogue and joint activity—is considered essential in order to share that knowledge with others (Nonaka and Takeuchi 1995). Other research observes that learning and sharing is enhanced when people interact in specific contexts where they are confronted with unique sources of information, experience different constraints, and have access to particular tools to solve problems (Brown and Duguid 1991; Tyre and von Hippel 1997; von Hippel and Tyre 1995). Cramton (1999) noted that, despite having similar educational backgrounds, technology-enabled dispersed student teams lacked "mutual knowledge" of each member's physical situation, which hindered their ability to identify the root causes of miscommunication and develop effective work practices. These findings regarding the situated nature of knowledge present significant problems when sharing knowledge among dispersed work settings.

Collective knowledge also develops through repetitive collective action and resides in systemic routines or ways of interacting (Badaracco 1991; Collins 1983; Granovetter 1985; Kogut and Zander 1992; Levitt and March 1988; Nelson and Winter 1982). Such collective knowledge is "expressed in regularities by which members cooperate in a social community" (Kogut and Zander 1992, p.383). Implicit shared meanings become associated with particular behavior within the community, facilitating efficient and effective communications. These associated meanings are learned over time and are, therefore, unlikely to be shared by dispersed group members who haven't previously interacted. In addition, since community members themselves gradually take this knowledge for granted, they cannot readily isolate it nor easily articulate it to colleagues from other communities.

The preceding arguments suggest that effective knowledge sharing in dispersed, cross-functional teams is likely to be neither simple nor effortless, especially during the early stages of group development. Yet if such teams *can* develop appropriate

knowledge sharing practices—habitual sharing behavior that all members recognize and understand—they should achieve superior outcomes to more homogeneous groups.

Proposition 1: *Effective team knowledge sharing practices will be associated with effective dispersed, cross-functional team outcomes.*

2.2 Technology Use Norms as Collective Knowledge

Shared norms vis-à-vis technology use can be considered a particular instance of collective knowledge. Just as people develop routines of interaction and accepted behaviors to efficiently accomplish collective outcomes, so can they also learn to use collaborative technologies routinely in ways that lead to shared meanings being associated with particular forms of technology-enabled interactions (Orlikowski and Yates 1994). When dispersed team members share expectations regarding technology use, this collective knowledge might facilitate their exchanges, despite their inherently different sources of domain knowledge.

Although most prior research has focused on particular individual technologies, rather than considering the available technologies as a “tool set,” we can still draw some conclusions as to how their combined use may be shaped. For instance, the immediate settings and communities in which members of dispersed teams work and socialize are likely to shape individuals’ technology uses and expectations (e.g., Alavi and Yoo 1997; Barley and Tolbert 1997; DeSanctis and Poole 1994; Fulk 1993; Orlikowski 1992; Orlikowski and Gash 1994). Collaborative technologies are, by virtue of their collective use, subject to critical mass and network externality effects and are thus particularly prone to a social structuring process. Research on e-mail use showed that the usage patterns of early adopters can substantially influence subsequent users’ expectations and practices (Markus 1994). Similarly, Orlikowski et al.’s study (1995) exposed how particular individuals intentionally shaped other users’ interactions with computer-conferencing technology by tailoring particular features of the technology and its context of use. The “interpretive flexibility” (Orlikowski 1992) and open-ended nature of many such technologies allows them to be used in a variety of ways and situations that meet the specific needs of a workgroup or occupational role. Thus individuals’ technology use patterns might correspond largely to those of the communities—whether local or role-related—to which they belong and with whom they most frequently interact.

Shared understanding and expectations regarding technology use are not derived solely from their particular use by others. The surrounding organizational context, including organizational structures, policies, conditions and consequences (Ciborra and Patriotta 1998; Orlikowski and Gash 1994), and the conditions and timing of training or exposure to a technology (Leonard-Barton 1987; Nielsen 1997), can also influence perceptions and usage of that technology. Such influences may be local or global within the organization.

Thus each team member’s habitual technology use may derive from a combination of local, role-related, and organizational level influences, and members may come to their teams with vastly different expectations around technology use. These differences are expected to influence the dispersed team’s development of its own shared values and expectations regarding technology use to support knowledge sharing and exchange.

Proposition 2: *Existing technology use norms derived from team members’ roles or occupations will influence the development of team knowledge sharing practices.*

Proposition 3: *Existing technology use norms derived from team members’ locations will influence the development of team knowledge sharing practices.*

This research explores the relationships among prior technology use norms, the development of team knowledge sharing practices, and team effectiveness.

3. RESEARCH METHODOLOGY

In the research study described here, we sought to understand uncontrolled behavior in contemporary settings, and the research strategy was chosen with this in mind. A qualitative, field-based study enabled us to acknowledge and explore the effects of organizational context and the expected emergent processes. Few prior studies have explored, concurrently, the use of multiple technologies; thus, although the literature guided us in thinking about potentially important aspects, we attempted to remain open to new insights that could emerge from the field.

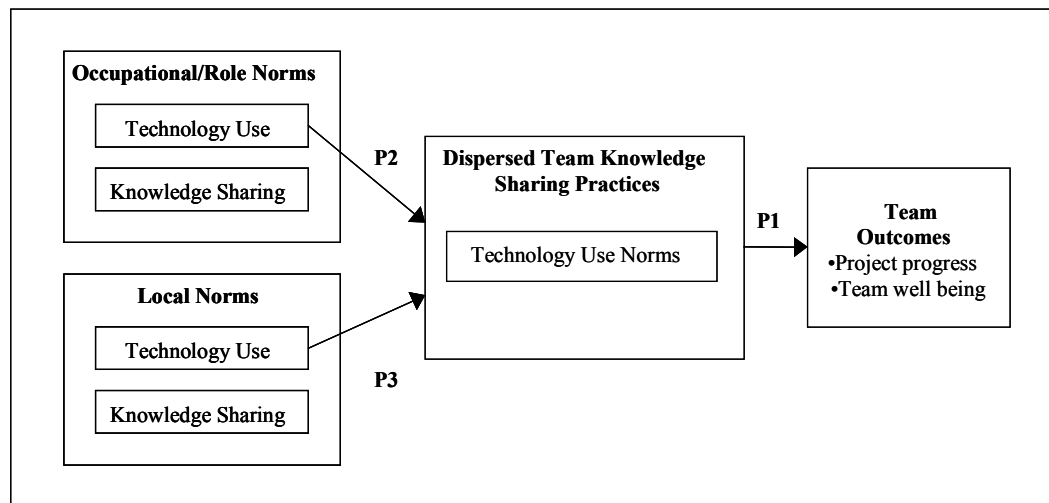


Figure 1. Research Framework

3.1 Site Selection

Our research site was DevCo,² a leading manufacturer of value-added materials used in industrial and consumer products. DevCo employs over 4,000 people worldwide and company revenues exceed \$1 billion per year. All major development efforts at DevCo involve representatives from marketing, sales, research and development, manufacturing, and technical service activities, drawn from operating sites on four continents. We selected development teams from a single organization in order to constrain extraneous variation at an industry and environmental level (Eisenhardt 1989), but retain sufficient contextual variance in terms of different cultural and geographical settings. As the result of a recent merger, DevCo also provided an ideal research site in which to explore the downstream effects of different technology use origins.

Sampling of development projects was theoretical (Glaser and Strauss 1967; Yin 1994), based on the opportunities they provided to observe cross-site and cross-functional interactions. Two projects were initially selected that were at equivalent stages of the company's standard "stage-gate" development process. Both were significant in terms of investment, risk, and complexity. The projects differed in the physical sites involved and in the tenure of the teams. Both teams comprised key members from at least three physical locations, although not all members were equally active during the period of research contact. Subsequently, additional projects were included, providing further variation on group tenure, development stage, and task complexity. Teams had access to a range of technological tools to support their work. These included technologies to support "same time, different place" collaborations—audio-conferencing, video-conferencing, application sharing—as well as those to enable "different time, different place" collective work—such as electronic messaging, computer conferencing (threaded discussions), workflow organization, and shared, structured document repositories.

3.2 Data Collection

Empirical materials for this study were collected at different levels and through a variety of methods: semi-structured and unstructured interviews, reviews of company and project documentation, observation of and participation in project/team and organizational activities. This triangulation of various techniques of data collection provided multiple perspectives on issues, and allowed for cross-checking of existing and emerging concepts (Eisenhardt 1989; Glaser and Strauss 1967; Pettigrew 1990).

Initial semi-structured interviews were conducted with a cross-section of the development community to gather data about each physical site and the organization as a whole. These interviews, in conjunction with recommendations by the relevant site management, provided the basis for choosing team projects to study in greater detail. Data on projects and teams was gathered primarily through in-depth interviews with team members from multiple sites, management, and other project associates. These allowed both retrospective and prospective documentation of each project and exploration of knowledge sharing practices both

²A pseudonym.

within and across team boundaries. A month spent in the field enabled “observation” of both physical and virtual team interactions of the first two project teams. Ongoing access to shared electronic repositories of project and organization information sources provided the means to triangulate interviewee reports and observed behavior.

Table 1. Summary of Data Collection Techniques and Sources

Level of Data Collection	Organization	Project-Team
Data collection techniques	Semi-structured interviews Electronic documentation review	Semi-structured interviews Unstructured interviews Electronic documentation review Observation
Informants	Cross-section of development community at representative sites, including: <ul style="list-style-type: none"> – R&D management – Engineering management – Research scientists – Process engineers – Market development managers – Application development managers – Technical service representatives 	Representative selection of project participants, including: <ul style="list-style-type: none"> – Core team members – Functional management – Peripheral/supporting participants
Interview topics	<ul style="list-style-type: none"> – Organizational background and nature of current development activities – Culture of site and organization – Meaning of collaboration and knowledge sharing in current activities – Use of collaborative technologies in current activities – Key barriers to dispersed collaboration and knowledge sharing 	<p>Same as for organization. Plus:</p> <ul style="list-style-type: none"> – Review of project history – Exploration of significant learning incidents/ episodes, addressing who, what, how questions – Perceptions of project performance – Perceptions of team relationships

4. CURRENT STATUS AND PROPOSED PRESENTATION

At the time of writing, data analysis is in progress. Preliminary findings indicate that teams develop a selection of distinct knowledge sharing purposes and practices during their development work. The effectiveness of knowledge sharing in the long run seems to depend less on the features or characteristics of the particular technology medium chosen, and more substantially on the extent to which sharing practices, exercised through particular technology use, are well-established and represent habitual action within the team. Although established technology use norms and sharing practices do not, in themselves, assure efficient project progress, a lack of clarity around technology-enabled sharing practices does seem to contribute detrimentally to overall team integrity and individual satisfaction within the team.

Time permitting, the presentation will address:

- Statement of the problem;
- Overview of conceptual framework and study design;
- Discussion of the main findings; and
- Discussion of implications for theory and practice.

Acknowledgements

Helpful and constructive comments from one anonymous ICIS associate editor and two anonymous ICIS reviewers are gratefully acknowledged. The Division of Research at the Harvard Business School provided financial support for this research.

References

- Alavi, M., and Leidner, D. "Knowledge Management Systems: Emerging Views and Practices from the Field," Working Paper, College of Business and Management, University of Maryland at College Park, 1997.
- Alavi, M., and Yoo, Y. "A Social Influence Model of Groupware Acceptance in Distributed Teams," Working Paper 97-053, Harvard Business School 1997.
- Argote, L., and Ingram, P. "Knowledge Transfer: A Basis for Competitive Advantage in Firms," *Organizational Behavior and Human Decision Processes* (82:1), 2000, pp. 150-169.
- Badaracco, J. L. *The Knowledge Link: How Firms Compete through Strategic Alliances*, Boston: Harvard Business School Press, 1991.
- Barley, S. R., and Tolbert, P. S. "Institutionalization and Structuration: Studying the Links Between Action and Institution," *Organization Studies* (18:1), 1997, pp. 93-117.
- Bechky, B. "Creating Shared Meaning Across Occupational Communities: An Ethnographic Study of a Production Floor," in *Academy of Management Conference*, S. J. Havlovic (ed.), Academy of Management, Chicago, 1999.
- Boutellier, R., Gassmann, O., Macho, H., and Roux, M. "Management of Dispersed Product Development Teams: The Role of Information Technologies," *R&D Management* (28:1), 1998, pp. 13-26.
- Brown, J. S., and Duguid, P. "Organizational Learning and Communities of Practice: Toward a Unified View of Working, Learning and Innovation," *Organization Science* (2), 1991, pp. 40-57.
- Brown, S., and Eisenhardt, K. "Product Development: Past Research, Present Findings, and Future Directions," *Academy of Management Review* (20:2), 1995, pp. 343-378.
- Ciborra, C. U., and Patriotta, G. "Groupware & Teamwork in R&D: Limits to Learning and Innovation," *R&D Management* (28:1), 1998, pp. 43-52.
- Collins, H. "The Structure of Knowledge," *Social Research* (60), 1983, pp. 95-116.
- Constant, D., Sproull, L., and Kiesler, S. "The Kindness of Strangers: The Usefulness of Electronic Weak Ties for Technical Advice," *Organization Science* (7:2), 1996, pp. 119-135.
- Cramton, C. D. "The Mutual Knowledge Problem and Its Consequences in Geographically Dispersed Teams," Working Paper, George Mason University, 1999.
- Cramton, C. D., and Webber, S. S. "A Model of the Effects of Geographical Dispersion on Work Teams," Working Paper, George Mason University, 1999.
- Davenport, T. H., and Prusak, L. *Working Knowledge: How Organizations Manage What They Know*, Boston: Harvard Business School Press, 1998.
- De Meyer, A. "Internationalizing R&D Improves a Firm's Technical Learning," *Research Technology Management* (36:4), 1993a, pp. 42-49.
- De Meyer, A. "Management of an International Network of Industrial R&D Lab," *R&D Management* (23:2), 1993b, pp. 109-121.
- DeSanctis, G., and Poole, M. S. "Capturing the Complexity in Advanced Technology Use: Adaptive Structuration Theory," *Organization Science* (5:2), 1994, pp. 121-147.
- Dougherty, D. "Interpretive Barriers to Successful Product Innovation in Large Firms," *Organization Science* (3:2), 1992, pp. 179-202.
- Duarte, D. L., and Snyder, N. T. *Mastering Virtual Teams*, San Francisco: Jossey-Bass Publishers, 1999.
- Eisenhardt, K. "Building Theories from Case Study Research," *Academy of Management Review* (14:4), 1989, pp. 532-550.
- Fulk, J. "Social Construction of Communication Technology," *Academy of Management Journal* (36:5), 1993, pp. 921-950.
- Garvin, D. "A Note on Knowledge Management," Technical Note 9-398-031, Harvard Business School, 1997.
- Glaser, B., and Strauss, A. *The Discovery of Grounded Theory: Strategies of Qualitative Research*, London: Wiedenfield and Nicholson, 1967.
- Goodman, P. S., and Darr, E. D. "Exchanging Best Practices Through Computer-Aided Systems," *Academy of Management Executive* (10:2), 1996, pp. 7-19.
- Goodman, P. S., and Darr, E. D. "Computer-Aided Systems and Communities: Mechanisms for Organizational Learning in Distributed Environments," *MIS Quarterly* (22:4), 1998, pp. 417-440.
- Gorton, I., and Motwani, S. "Issues in Cooperative Software Engineering Using Globally Distributed Teams," *Information and Software Technology* (38:10), 1996, pp. 647-656.
- Granovetter, M. "Economic Action and Social Structure: The Problem of Embeddedness," *American Journal of Sociology* (91:3), 1985, pp. 481-510.
- Grant, R. "Prospering in Dynamically Competitive Environments: Organizational Capability as Knowledge Integration," *Organization Science* (7:4), 1996, pp. 375-387.
- Handy, C. "Trust and the Virtual Organization," *Harvard Business Review* (73:3), 1995, pp. 40-49.
- Hansen, M.T., Nohria, N., and Tierney, T. "What's Your Strategy for Managing Knowledge?" *Harvard Business Review* (77:2), 1999, pp. 106-117.

- Jarvenpaa, S., Knoll, K., and Leidner, D. "Is Anybody out There? Antecedents of Trust in Global Virtual Teams," *Journal of Management Information Systems* (14:4), 1998, pp. 29-64.
- Kogut, B., and Zander, U. "Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology," *Organization Science* (3:3), 1992, pp. 383-397.
- Lam, A. "Embedded Firms, Embedded Knowledge: Problems of Collaboration and Knowledge Transfer in Global Cooperative Ventures," *Organization Studies* (18:6), 1997, pp. 973-996.
- Leonard, D. *Wellsprings of Knowledge: Building and Sustaining the Sources of Innovation*, Boston: Harvard Business School Press, 1995.
- Leonard, D. A., Brands, P. A., Edmondson, A., and Fenwick, J. "Virtual Teams: Using Communications Technology to Manage Geographically Dispersed Development Groups," in *Sense and Respond: Capturing Value in the Network Era*, S. P. Bradley and R. L. Nolan (eds.), Boston: Harvard Business School Press, 1998, 285-298.
- Leonard-Barton, D. "Implementing Structured Software Methodologies: A Case of Innovation in Process Technology," *Interfaces* (17:3), 1987, pp. 6-17.
- Levitt, B., and March, J. G. "Organizational Learning," *Stanford University Annual Review of Sociology* (14), 1988, pp. 319-340.
- Madhavan, R., and Grover, R. "From Embedded Knowledge to Embodied Knowledge: New Product Development as Knowledge Management," *Journal of Marketing* (62:4), 1998, pp. 1-12.
- Markus, M. L. "Electronic Mail as the Medium of Managerial Choice," *Organization Science* (5:4), 1994, pp. 502-527.
- Nelson, R., and Winter, S. *An Evolutionary Theory of Economic Change*, Cambridge: The Belknap Press, 1982.
- Nielsen, R.E. *Collaborative Technologies and Organizational Learning*, Hershey, PA: Idea Group Publishing, 1997.
- Nonaka, I., and Takeuchi, H. *The Knowledge-Creating Company: How Japanese Companies Create the Dynamics of Innovation*, New York: Oxford University Press, 1995.
- Orlikowski, W. J. "The Duality of Technology: Rethinking the Concept of Technology in Organizations," *Organization Science* (3:3), 1992, pp. 398-427.
- Orlikowski, W. J., and Gash, D. "Technological Frames: Making Sense of Information Technology in Organizations," *ACM Transactions on Information Systems* (12:2), 1994, pp. 174-207.
- Orlikowski, W. J., and Yates, J. "Genre Repertoire: Examining the Structuring of Communicative Practices in Organizations," *Administrative Science Quarterly* (39:4), 1994, pp. 541-574.
- Orlikowski, W. J., Yates, J., Okamura, L., and Fujimoto, M. "Shaping Electronic Communication: The Metastructuring of Technology in the Context of Use," *Organization Science* (6:4), 1995, pp. 423-444.
- Pettigrew, A. M. "Longitudinal Field Research on Change: Theory and Practice," *Organization Science* (1:3), 1990, pp. 267-292.
- Pickering, J. M., and King, J. L. "Hardwiring Weak Ties: Interorganizational Computer-Mediated Communication, Occupational Communities, and Organizational Change," *Organization Science* (6:4), 1995, pp. 479-486.
- Polanyi, M. *The Tacit Dimension*, New York: Doubleday & Company, Inc., 1966.
- Prokesch, S. E. "Unleashing the Power of Learning: An Interview with British Petroleum's John Browne," *Harvard Business Review* (75:5), 1997, pp. 147-164.
- Rennecker, J. "Overlap and Interplay: Cultural Structuring of Work and Communication in One Virtual Work Group," Report, Sloan School of Management, Massachusetts Institute of Technology, 1999.
- Ruggles, R. "The State of the Notion," *California Management Review* (40:3), 1998, pp. 80-89.
- Ryle, G. *The Concept of Mind*, London: Huchinson, 1949.
- Schumpeter, J. A. *The Theory of Economic Development* (Redvers Opie, trans.), Cambridge, MA: Harvard University Press, 1934.
- Szulanski, G. "Unpacking Stickiness: An Empirical Investigation of the Barriers to Transfer Best Practice inside the Firm," *Academy of Management Journal* (Best Papers Proceedings 1995), 1995, pp. 437-441.
- Townsend, A. M., DeMarie, S. M., and Hendrickson, A. R. "Virtual Teams: Technology and the Workplace of the Future," *Academy of Management Executive* (12:3), 1998, pp. 17-29.
- Tyre, M. J., and von Hippel, E. "The Situated Nature of Adaptive Learning in Organizations," *Organization Science* (8:1), 1997, pp. 71-83.
- von Hippel, E. "'Sticky Information' and the Locus of Problem Solving: Implications for Innovation," *Management Science* (40:4), 1994, pp. 429-439.
- von Hippel, E., and Tyre, M. "How Learning by Doing Is Done: Problem Identification in Novel Process Equipment," *Research Policy* (24), 1995, pp. 1-12.
- Yin, R. K. *Case Study Research: Design and Methods* (2nd ed.), London: Sage Publications, 1994.
- Zack, M. "Managing Codified Knowledge," *Sloan Management Review* (40:4), 1999a, pp. 45-58.
- Zack, M. H. "Developing a Knowledge Strategy," *California Management Review* (41:3), 1999b, pp. 125-146.
- Zander, U., and Kogut, B. "Knowledge and the Speed of Transfer and Imitation of Organizational Capabilities: An Empirical Test," *Organization Science* (6:1), 1995, pp. 76-92.